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(54) Method for treating material for implantation and implant.

(57) A method for treating of material for implantation such as cartilage uses microwave radiation prior to implantation. Resorption of the implants is decreased.

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Method for treating material for implantation and implant

Resorption of implants made of non-vital tissue is one of the problems in obtaining good results in operations. On the other hand implants of synthetic material bring the danger of infection in the long term. The present invention relates to implants of non-vital tissue.

Various proposals have been made for the treating of implants prior to implantation. At the moment allogenous rib cartilage is generally kept immersed in merthiolate or cialite at 4° C.

The present invention has for its object to provide an improved method for treating material for implantation prior to implanting. The present invention therefore provides a method as according to claim 1.

Initial tests have been carried out on rib cartilage to be implanted into a rabbit. A first area of application appears to be the replacement of nasal septums.

Applications are currently being researched in which skin is treated according to the present invention for repairing physical damage after burn injuries for example.

Other known techniques such as decalcification with HCL are directed at the denaturing of proteins or cross-linking of collagenous molecules as a result of which a probable decrease of the antigenic properties of the implant is achieved.

Internally generated heat can be used through microwave for the denaturing of proteins and at the high temperatures thus achieved the diffusion velocity of reagents is increased in addition to the chemical reaction speed. Obtained through a homogeneous rise in temperature is a denaturing of protein and the formation of disulphide bridges in aggregated protein. As a result tissue that has been exposed to microwave radiation probably contains a coarse network of coagulated protein through which fixatives diffuse more easily. The extent of polymerization of glutaraldehyde can also be improved with microwave radiation. The toxic effect on the surrounding tissue is hereby avoided, and the cross-linkage becomes more complete.

A sterile implant can be manufactured in this way and in particular the retro-viruses (AIDS virus) can be eliminated. The temperature of 60° C reached during the treatment and the presence of alcohol also reduce the virulence of the retro-virus (AIDS virus) such that infection of the recipient with virus is substantially excluded.

The experiments described hereinafter were carried out in a standard kitchen microwave oven; other experiments were performed in a Biorad H2500 microwave oven which is now commercially available and which enables a good temperature control in the interior of the microwave oven.

The present invention will be elucidated with reference to practical experiments performed under the experimental conditions given in the following table.

TABLE

DIFFERING MICROWAVE TREATMENTS				
Experiment number	solution	radiation duration	temp.	dose (Watt)
1	cialite	5 minutes	50° C	150
2	cialite	20 minutes	50° C	150
3	cialite	10 minutes	80° C	450
4	alcohol	5 minutes	60° C	150
5	alcohol	10 minutes	60° C	150
6	dry	3 minutes (not radiated)	60° C	150

Under the above conditions treated or refined rib cartilage implants were taken from fresh human skeletons. The rib cartilage was cleaned of adhering tissue, whereby the perichondrium remained intact. Microwave radiation was applied to the 3 mm thick pieces of rib cartilage in a Miele M698 in which the immersion liquid, radiation time, temperature and power level applied were varied.

The implants were introduced under anaesthetic into eight adult rabbits of 1.5-1.9 kg in weight. Incisions were made vertically on the spinal column and the various implants were inserted into the subcutaneous tissue of the back. The skin was sutured with vicriel 4x0. No post-operative antibiotic treatment was given. Cartilage implants were removed after 12 and 40 weeks and observed. The results of experiments 1-5 were better than with untreated cartilage (experiment 7).

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The radiated cartilage had preserved its normal structure, strength and elasticity and no difference could be observed macroscopically in a comparison with the non-treated cartilage.

The cartilage implants were found during removal to have displaced in the case of various animals, but could be identified easily. After 12 weeks of implantation the implant numbered 7 (not radiated) could easily be distinguished from the other implants. The cartilage displayed central necrosis with nuclear debris while granulocytes were present. Macrophages were concentrated around the edges of the implant and an extensive infiltration of macrophages in the cartilage tissue was clearly observable. In the case of the implants treated with microwave (experiments 1-6) better results could be observed microscopically. It can be stated generally after 12 weeks of implant that the results ran from good to poor as follows: No. 5, No. 4, No. 1, No. 2, No. 3 with No. 6 as the worst.

40 weeks after implantation a greater difference in microscopic appearance could be seen. The non-treated implants once again displayed the most pronounced resorption by macrophages and the cartilage was centrally fragmented with areas of necrotic tissue around the fragments. These changes were less noticeable than 12 weeks after implantation. In the case of the implants exposed to microwave treatment some macrophages were seen around the edges and in some places even in the cartilage, but fragmentation or central necrosis was not observed. There had been hardly any progression in the resorption process as in the untreated implants. The results could be summarised in sequence as follows: No. 4, No. 5, No. 2, No. 1, No. 3, No. 6.

Claims

1. Method for treating a piece of material for implantation, such as cartilage, bone, skin, tendons, cardiac valves or vascular tissue, whereby said material is exposed for a predetermined period of time to microwave radiation.

2. Method as claimed in claim 1, whereby the piece of material is exposed to the action of a liquid reagent during exposure to microwave radiation.

3. Method as claimed in claim 2, whereby the liquid reagent is selected from a group comprising alcohol, glutaraldehyde, glycerine, glycerol.

4. Method as claimed in claim 1, 2 or 3, whereby a predetermined period of time lies between 3 and 20 minutes at a power feed level of 80 to 450 watts.

5. Material for implantation treated in accordance with any of the methods from the claims 1, 2, 3 or 4.

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EUROPEAN SEARCH REPORT

Application Number

EP 88 20 2576

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	WO-A-8 500 954 (THE TRUSTEES OF COLUMBIA UNIVERSITY IN THE CITY OF NEW YORK) * Claim 11 *		A 61 L 27/00
A	US-A-4 456 589 (D.G. HOLMAN et al.) * Column 2, lines 10,11; claims 1,2 *		
A	FR-A-1 317 584 (OLIN MATHIESON) * Abstract *		
A	EP-A-0 015 055 (COLLAGEN CORP.) * Page 3, lines 10,19 *		

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TECHNICAL FIELDS SEARCHED (Int. Cl.4)

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26-01-1989	PELTRE CHR.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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